AbstractID: 8402 Title: Accuracy of the Monte Carlo dose calculation algorithm for Cyberknife treatment of small lung lesions

Purpose: To assess the accuracy of dose calculations for Cyberknife treatment of small lung tumors, performed with the Monte Carlo Dose Calculation algorithm (Multiplan v2.1 and later). **Method and Materials:** Verification measurements were performed in slab phantoms and in a newly constructed anthropomorphic thorax phantom, both made tissue equivalent materials (Gammex RMI). The modular thorax phantom can be configured with spherical Solid Water tumors of 10, 20 or 30 mm in diameter, embedded in lung tissue equivalent material. Measurements were mainly performed with Gafchromic EBT film, complemented with single point diode measurements. Single beam experiments were performed for various slab phantoms for cones of 5, 10, 20 and 60 mm beam diameter. Monte Carlo calculations were also compared with the simpler ray tracing dose calculation algorithm also available in MultiPlan. **Results:** Gafchromic EBT film measurements and Monte Carlo calculations for single beam irradiations of homogeneous slab phantoms were in excellent agreement with water phantom measurements and the ray tracing algorithm predictions. This proved that (1) our beam data was correctly modeled in the Monte Carlo algorithm, and (2) the Gafchromic EBT film was suitable for further experiments. For inhomogeneous slab phantoms, Monte Carlo calculated absolute doses generally agreed within 3% with measurements, even for the smallest field (5 mm). For the ray tracing algorithm, large deviations of up to 45% in the dose re-build area in tumor behind lung were observed. Also for the 3 solid lung tumors in the thorax phantom, Monte Carlo dose calculations were in excellent agreement with measurements, while with the ray tracing algorithm high dose areas were over-predicted both in size and in dose. **Conclusion:** Excellent agreement was found between Monte Carlo and measurements in inhomogeneous (anthropomorphic) phantoms. For treatment of (small) lung tumors Monte Carlo is the preferred dose calculation engine.